WHAT IS CLAIMED IS:

sub a2>

1. An active control device for improving air flow characteristics in a vicinity of an airfoil, the airfoil having an outer aerodynamic surface and an interior volume, the airfoil having a chord of predetermined length, the aerodynamic surface comprising a leading edge and a trailing edge, the active control device comprising:

at least one aperture disposed on the outer aerodynamic surface, said at least one aperture communicating the outer aerodynamic surface to the interior volume;

a chamber disposed within the interior volume, said chamber defining a volume in fluid communication with said aperture; and

at least one diaphragm defining a wall of said chamber, said at least one diaphragm being movable between a first position and a second position, wherein movement of said at least one diaphragm from said first position to said second position pushes air present in the interior volume through said at least one aperture and out of the interior volume, and wherein movement of said at least one diaphragm from said second position to said first position draws air through said at least one aperture and into the interior volume.

2. An active control device in accordance with claim 1, wherein:

said at least one aperture comprises a plurality of apertures.

3. An active control device in accordance with claim 2, wherein:

said at least one diaphragm comprises a plurality of diaphragms.

4. An active control device in accordance with claim 3, wherein:

a total number of said plurality of apertures corresponds to a total number of said plurality of diaphragms.

5. An active control device in accordance with claim 4, wherein:

each of said plurality of diaphragms pushes and draws air through a corresponding one of said plurality of apertures.

6. An active control device in accordance with claim 5, comprising:

a controller operatively coupled to said plurality of diaphragms, said controller controlling movement of said plurality of diaphragms.

Sub a3 >

7. An active control device in accordance with claim 6, comprising:

first and second sensors operatively coupled to said controller, said first and second sensors disposed on the aerodynamic surface, said first and second sensors measuring a flow characteristic of air proximal said first and second sensors.

Sub B1

8. An active control device in accordance with claim 7, wherein:

said controller regulates an oscillation frequency of at least one of said plurality of diaphragms in response to said flow characteristic of air measured by said first and second sensors.

9. An active control device in accordance with claim 7, wherein:

said controller regulates an oscillation amplitude of at least one of said plurality of diaphragms in response to said flow characteristic of air measured by said first and second sensors.

10. A system in accordance with claim 7, wherein:

said first and second sensors comprise at least one pressure transducer.

Sub a4 >

11. An active control device in accordance with claim 1, wherein:

said at least one aperture is disposed on the outer aerodynamic surface proximal the trailing edge.

12. An active control device in accordance with claim 1, wherein:

said at least one aperture is disposed along the aerodynamic surface a distance of at least 5 percent but not greater than 8 percent of the chord length from the trailing edge.

13. An active control device in accordance with claim 7, wherein:

said first and second sensors are disposed proximal the leading edge.

14. A method of neutralizing the negative effects of non-uniform flow of a fluid over an airfoil, the airfoil having an outer aerodynamic surface and an interior volume, the airfoil having a chord of predetermined length, the aerodynamic surface comprising an upper surface, a lower surface, a trailing edge and a leading edge, the method comprising:

forming at least one aperture disposed at a first position on the aerodynamic surface, said at least one aperture connecting the aerodynamic surface to the interior volume;

drawing a first portion of the fluid through said at least one aperture and into the interior volume; and

pushing said first portion of the fluid through said at least one aperture and out of the interior volume.

15. A method in accordance with claim 14, wherein:

said drawing and pushing steps are performed by at least one diaphragm disposed in the interior volume.

16. A method in accordance with claim 14, wherein:

said drawing and pushing steps are performed proximal the trailing edge.

17. A method in accordance with claim 14, wherein:

said drawing and pushing steps are performed selectively through the upper surface and the lower surface.

18. A method in accordance with claim 17, comprising:

selecting one of the upper surface or the lower surface through which said drawing and pushing steps are performed.

19. A method in accordance with claim 18, comprising:

sensing parameters of the non-uniform flow; and

selecting one of the upper surface or the lower surface through which said drawing and pushing steps are performed based upon said sensed parameters.

Sub B1

20. A method of neutralizing perturbations caused by non-uniform flow of a fluid stream over an airfoil having a leading edge and a trailing edge, the method comprising:

sensing a variable pressure associated with the fluid stream proximal the leading edge of the airfoil;

computing a perturbation frequency associated with said variable pressure; and

actuating an array of oscillating jets disposed proximal the trailing edge of said airfoil to cause said oscillating jets to oscillate at an actuating frequency, said actuating frequency being a function of said perturbation frequency.

21. The method of claim 20, further comprising:

computing a dominant frequency associated with said variable pressure and causing said oscillating jets to oscillate at an actuating frequency substantially equal to said dominant frequency.

22. The method of claim 20, further comprising:

sensing a variable differential pressure associated with said fluid stream; and

actuating one of a first and second array of oscillating jets disposed on an upper and lower surface of said airfoil in response to the arithmetic sign of said differential pressure.

Add B'